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**EUROPEAN PATENT APPLICATION**

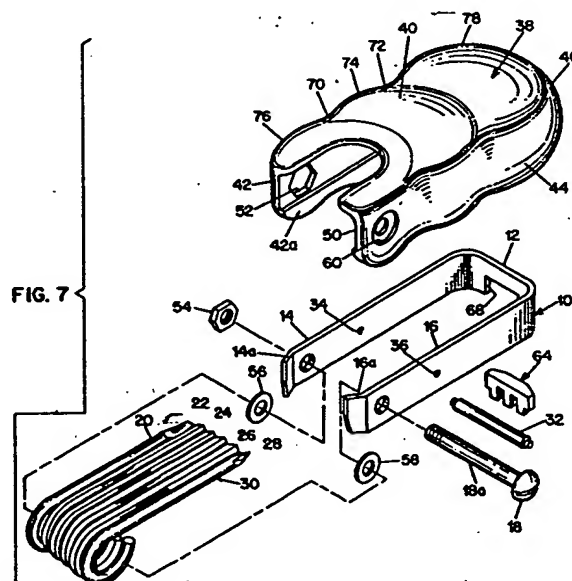
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**W-8000 München 90(DE)**(54) **Folding tool for bicycles.**

(57) A folding tool comprises a chassis (10) in the form of a generally U-shaped metal band having a base portion (12) and a pair of substantially parallel spaced-apart leg portions (14,16), an axle (18a) joined to the leg portions adjacent their free ends and transversely spanning the space between them, and a multiplicity of different elongated tools (20,30) pivotally received on the axle (18a) and individually pivotable selectively about the axle between a storage position in which they are received between the leg portions (14,16) of the chassis (10) and a deployed position in which they extend away from the chassis. A handle (38) having a top wall (40), a pair of side walls (42,44) and one end wall (46) receives the chassis (10) and is joined to it, the handle having a bottom opening (48) between the leg portions (42,44) of the chassis (10) and an end opening (50) between the free ends of the legs portions through which the tools are movable between their storage and deployed positions. The external surfaces of the top and side walls of the handle are contoured (70-78) to facilitate gripping.

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## Background of the Invention

For several years, Cannondale Corporation, the assignee of the present invention, has marketed a folding tool for bicycles that is very similar to a folding pocket knife, except that instead of having blades that fold into a storage position between two spaced-apart side walls and open out for use, it has screw drivers and allen wrenches. While the folding tool is compact and very handy to carry, it is not altogether comfortable to use and does not afford a very good grip when used. The two flat sides do not provide good finger or hand grips, and the openings between the sides are not at all satisfactory as grips. Also, the tool has a relatively large number of parts, which makes it fairly expensive to manufacture. The Cannondale folding bicycle tool, which has been widely copied, lacks a spoke wrench, a tool that is very useful to bicyclists.

## Summary of the Invention

One object of the present invention is to provide a folding tool that is ergonomically improved over the prior tool. Another object is to include a spoke wrench. Still a further object is to reduce the number of components and facilitate the assembly of the components and thereby reduce the costs of manufacture. It is also desired to provide an aesthetically pleasing folding tool.

The foregoing and other objects are attained, according to the present invention, by a folding tool having a chassis with an axle, a multiplicity of different elongated tools pivotally received on the axle and individually pivotable selectively about the axle between a storage position in which they are received between portions of the chassis and a deployed position in which they extend away from the chassis, and a handle attached to the chassis. The invention is characterized in that the chassis is in the form of a generally U-shaped metal band having a base portion at one end and a pair of elongated substantially parallel spaced-apart leg portions extending from the base portion and having free ends remote from the base portion, the axle being joined to the leg portions adjacent their free ends and transversely spanning the space between them, and in that the handle has a top wall, a pair of side walls and one end wall receiving the chassis and joined to it, the chassis being received in the handle with the leg portions engaging the side walls and the base portion engaging the end wall, in that the handle has a bottom opening between the leg portions of the chassis and an end opening between the free ends of the leg portions through which the tools are movable between their storage and deployed positions, and

in that the external surfaces of the top and side walls of the handle are contoured to facilitate gripping.

Advantageously, the external surfaces of the top and side walls of the handle have spaced-apart concavities and bulbous portions on either side of the concavities. The concavities are in the form of smoothly curved grooves that extend generally transversely and continuously along the top and side walls of the handle. The bases of the grooves may define generally a plane that is orthogonal to the top wall, whereby they are adapted for grasping by the fingers and thumb of a user.

In a preferred embodiment, a spoke wrench fitting is joined to the handle adjacent its end wall and has an opening defining jaws for gripping a spoke nut that faces in the same direction as the bottom opening of the handle. When the tools are in their storage position, they are set back within the handle to enable the spoke to intrude into the bottom opening and to be straddled by the side walls when the spoke wrench is fitted to the spoke. The base portion of the chassis and the end wall of the handle have notches that are aligned with the opening between the jaws of the spoke wrench and receive portions of the spoke and spoke nut when the spoke wrench is fitted to the spoke nut.

The axle is, preferably, a portion of a shank of a bolt that passes through a hole in one side wall of the handle and holes in the chassis and receives a nut that is recessed and keyed into the internal surface of the other side wall of the chassis, whereby the bolt and nut fasten the handle to the chassis. The internal surfaces of the side and end walls of the handle match and engage external surfaces of the chassis, and the bottom opening of the handle is bounded by a flange that engages and captures the edge of the chassis.

For a better understanding of the invention reference may be made to the following description of an exemplary embodiment, taken in conjunction with the accompanying drawings.

## Description of the Drawings

Fig. 1 is a top plan view of the embodiment;  
Fig. 2 is a side elevational view of the left side of the embodiment;  
Fig. 3 is a side elevational view of the right side of the embodiment;  
Fig. 4 is an end elevational view of the handle end of the embodiment;  
Fig. 5 is an end elevational view of the tool end of the embodiment;  
Fig. 6 is a bottom plan view of the embodiment;  
Fig. 7 is an exploded pictorial view of the embodiment;  
Fig. 8 is an end elevational view of the handle of

the embodiment, looking at the tool end;  
Fig. 9 is a bottom plan view of the handle of the embodiment; and  
Fig. 10 is a pictorial view showing how the spoke wrench is used.

#### Description of the Embodiment

The embodiment comprises a chassis 10 in the form of a metal band bent into a "U" shape such as to form a base portion 12 at one end and a pair of elongated parallel, spaced-apart leg portions 14 and 16 extending from the base portion and having free ends remote from the base portion. The shank 18a of a bolt 18 serves as an axle for six elongated tools, a slotted head screw driver 20, four sizes of allen wrenches 22, 24, 26, and 28, and a phillips head screw driver 30. The ends of the tools remote from the working tips are bent into loops, by which they are pivotally mounted on the bolt 18 for pivotal movement individually between a storage position in which they reside between the leg portions 14 and 16 of the chassis and a deployed position in which they extend out away from the chassis. Each of the free ends of the leg portions 14 and 16 has a small protuberance 14a, 16a stamped into it in an inward direction (toward the space between the leg portions) that interferes with the respective screw drivers 20 and 30 and holds them in the manner of a detent in the deployed position. A stop pin 32 is press-fitted into holes 34, 36 in the leg portions of the chassis and is engaged by the tools 20 - 30 when they are folded into their storage position between the leg portions.

The chassis 10 and tools 20 - 30 are received within a molded plastic handle 38. The handle has a top wall 40, a pair of side walls 42 and 44, a rear end wall 46, a bottom opening 48 defined by the edges of the side and rear end walls, and a front end opening 50 defined by the ends of the top wall and the side walls at the end opposite from the rear end wall 46. Internally, the side and rear end walls 42, 44 and 46 are formed to provide a receptacle for the chassis 10, the receptacle being shaped and dimensioned to match the external surface of the chassis. Edge flange portions 42a, 44a, and 46a project in at the bottom opening of the handle and engage the bottom edge of the chassis, thereby capturing it in the handle from below. The chassis 10 slides into the handle 38 through the front end opening 50 when the tool is assembled.

A recess 52 on the inside of the side wall 42 of the chassis 10 receives a nut 54, the recess matching the shape of the nut so that the bolt 18 can be tightened onto it. After the nut is installed in the recess, the chassis is slid into the handle, the tools are positioned to accept the axle bolt 18, washers

56 and 58 are

tool array, and the bolt is inserted through a countersunk hole 60 in the side wall 44, the tools and washers and threaded into the nut 54. Thereupon, the chassis and tools are securely retained in the handle, the chassis being held in the receptacle formed by the interior of the handle and the bolt and nut holding the chassis/tool assembly endwise.

A cavity 62 in the rear end wall 46 of the handle receives a spoke wrench fitting 64, which can either be molded in place in the handle or pressed into the previously molded handle. The fitting 64 has two wrench-openings 64a and 64b of different sizes for use with different sized spoke nuts. A notch 66 in the rear end wall 46 of the handle and a notch 68 in the base portion 12 of the chassis 10 register with the wrench-openings of the fitting 64 and accept the shank of the spoke nut when the spoke wrench is used (see Fig. 10). The stop pin 32 is located relative to the chassis such that the working tips of the tools, when in their storage positions, are recessed into the bottom opening 48 of the handle sufficiently to allow the spoke to intrude into the portion of the bottom opening adjacent the spoke wrench - the spoke forms a small angle with the plane of the bottom opening when the spoke wrench is applied to the spoke nut.

The external surface of the handle 38 is sculptured to provide finger and thumb grips in the form of spaced-apart, smoothly curved grooves or concavities 70 and 72 extending transversely and continuously along the top wall 40 and side walls 42 and 44, a smoothly curved bulbous portion 74 between the concavities, and smoothly rounded bulbous portions 76 and 78 adjacent the front and rear ends. The end wall 46 is smoothly rounded at the junctures with the side and top walls, also for improved comfort and ergonomic characteristics.

#### Claims

1. A folding tool having a chassis (10) with an axle (18), a multiplicity of different elongated tools (20, 22, 24, 26, 28, 30) pivotally received on the axle and individually pivotable selectively about the axle between a storage position in which they are received between portions of the chassis and a deployed position in which they extend away from the chassis, and a handle (38) attached to the chassis, characterized in that the chassis (10) is in the form of a generally U-shaped metal band having a base portion (12) at one end and a pair of elongated substantially parallel spaced-apart leg portions (14, 16) extending from the base portion and having free ends remote from the base portion, the axle (18) being joined to the

- leg portions adjacent their free ends and transversely spanning the space between them, and in that the handle (38) has a top wall (40), a pair of side walls (42, 44) and one end wall (46) receiving the chassis and joined to it, the chassis being received in the handle with the leg portions engaging the side walls and the base portion engaging the end wall, in that the handle has a bottom opening between the leg portions of the chassis and an end opening between the free ends of the legs portions through which the tools are movable between their storage and deployed positions, and in that the external surfaces of the top and side walls of the handle are contoured to facilitate gripping.
2. A folding tool according to claim 1 and further characterized in that the external surfaces of the top and side walls (40,42,44) of the handle have spaced apart concavities (70, 72) and bulbous portions (74, 76, 78) on either side of the concavities.
  3. A folding tool according to claim 2 and further characterized in that the concavities are smoothly curved grooves that extend generally transversely and continuously along the top and side walls of the handle.
  4. A folding tool according to claim 3 and further characterized in that the bases of the grooves define generally a plane that is orthogonal to the top wall, whereby they are adapted for grasping by the fingers and thumb of a user.
  5. A folding tool according to claim 1 and particularly adapted for use with bicycles and further comprising a spoke wrench fitting (64) joined to the handle (38) adjacent its end wall (46) and having a wrench-opening (64a or 64b) defined by jaws for gripping a spoke nut that faces the bottom opening of the handle.
  6. A folding tool according to claim 5 and further characterized in that the tools in their storage position are set back within the handle to enable the spoke to intrude into the bottom opening and to be straddled by the side walls when the spoke wrench is fitted to the spoke.
  7. A folding tool according to claim 1 and further characterized in that the axle (18) is a portion of a shank (18a) of a bolt that passes through a hole in one side wall (42) of the handle and holes in the chassis and receives a nut (54) that is recessed and keyed into the internal surface of the other side wall of the chassis, whereby the bolt and nut fasten the handle to the chassis.
  8. A folding tool according to claim 7 and further characterized in that the internal surfaces of the side and end walls (42, 44, 46) of the handle match and engage external surfaces of the chassis and the bottom opening of the handle is bounded by an intumed flange (42a, 44a, 46a) that engages and captures the edge of the chassis.
  9. A folding tool according to claim 5 and further characterized in that the base portion (12) of the chassis and the end wall (46) of the handle have notches (68, 66) that are aligned with the opening between the jaws of the spoke wrench (64) and receive portions of the spoke and spoke nut when the spoke wrench is fitted to the spoke nut.

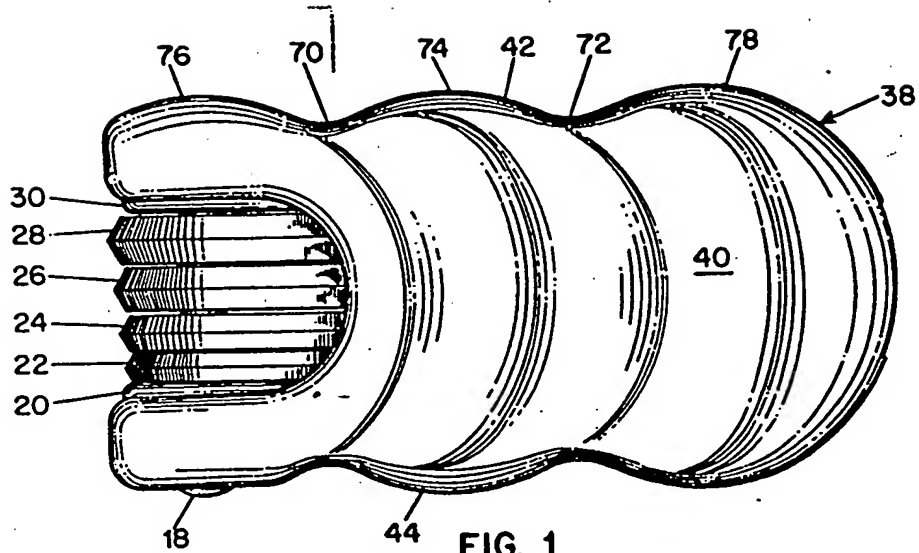


FIG. 1

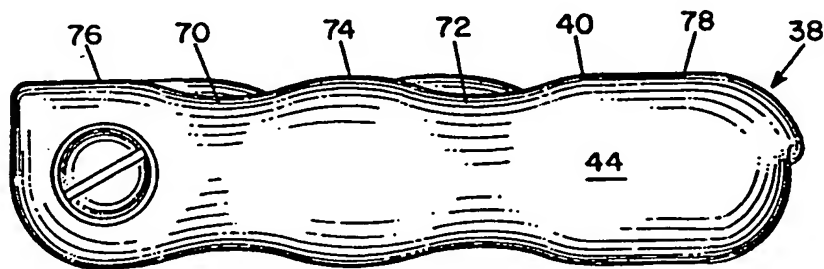


FIG. 2

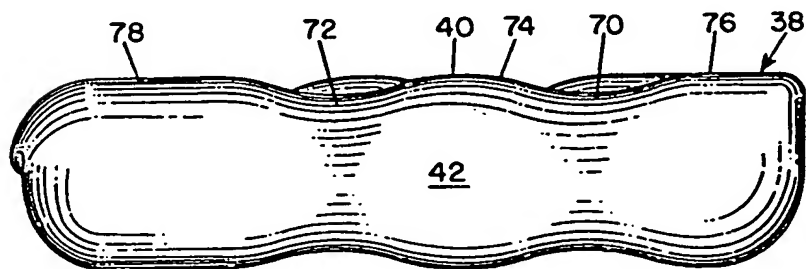


FIG. 3

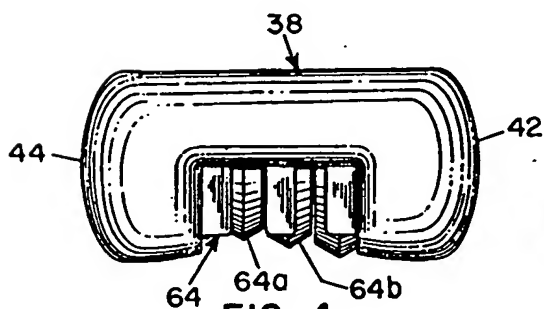


FIG. 4

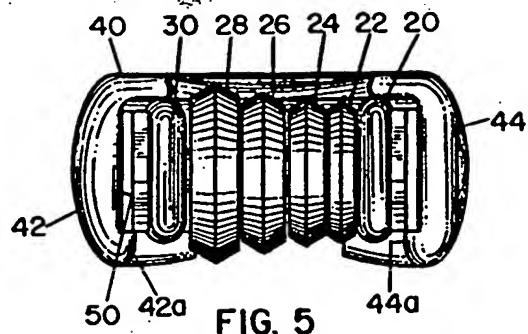


FIG. 5

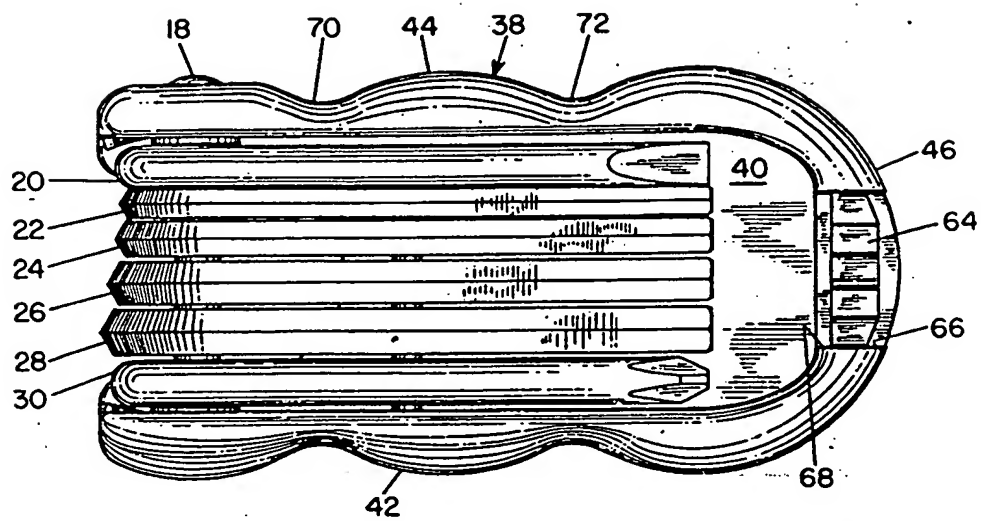


FIG. 6

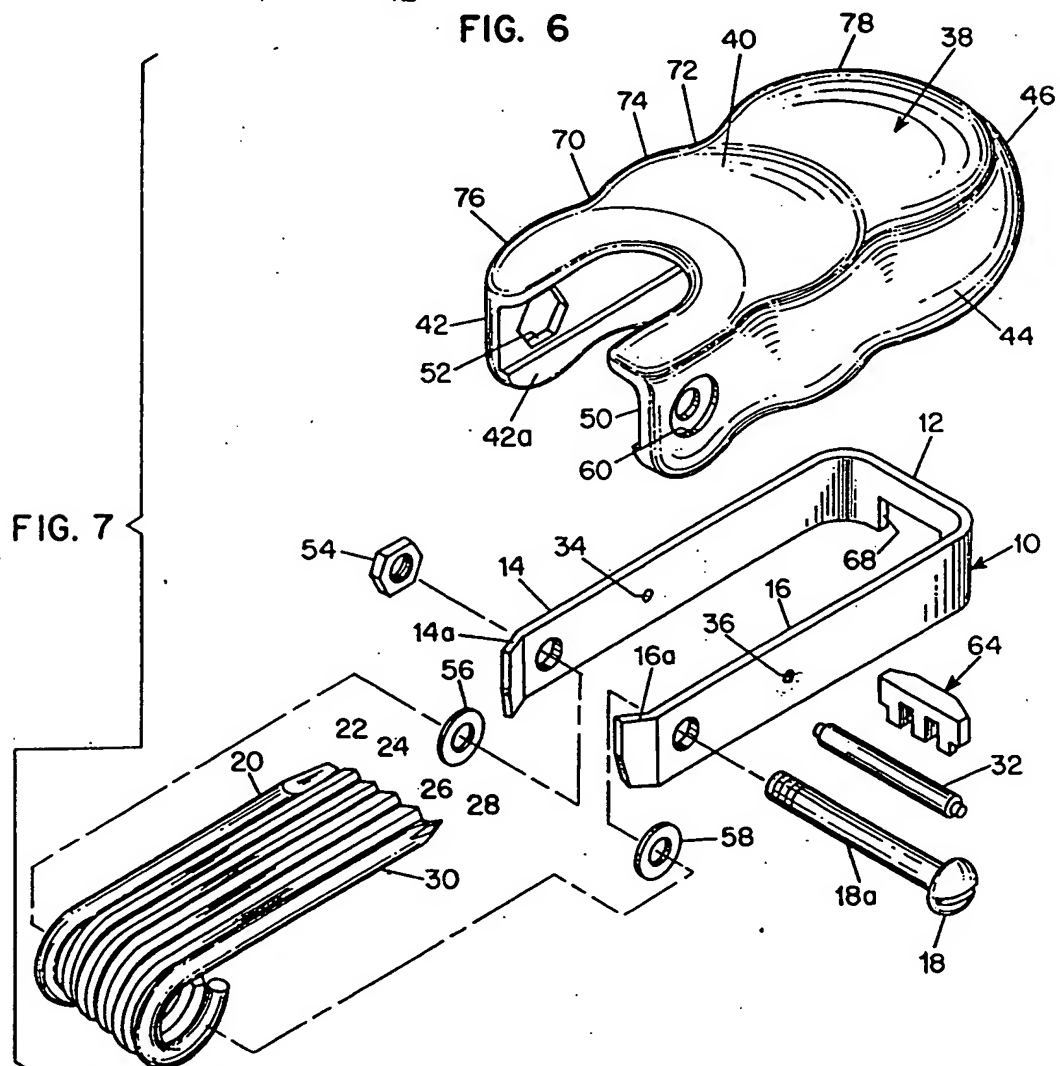


FIG. 7

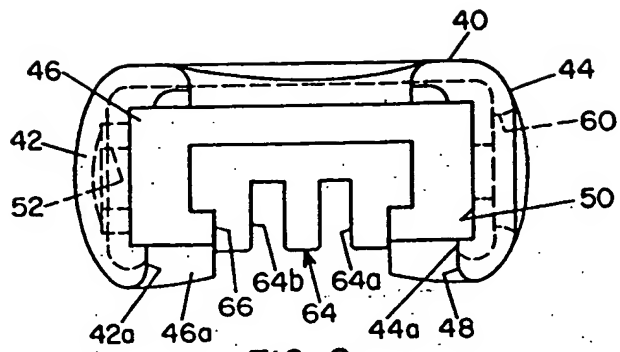


FIG. 8

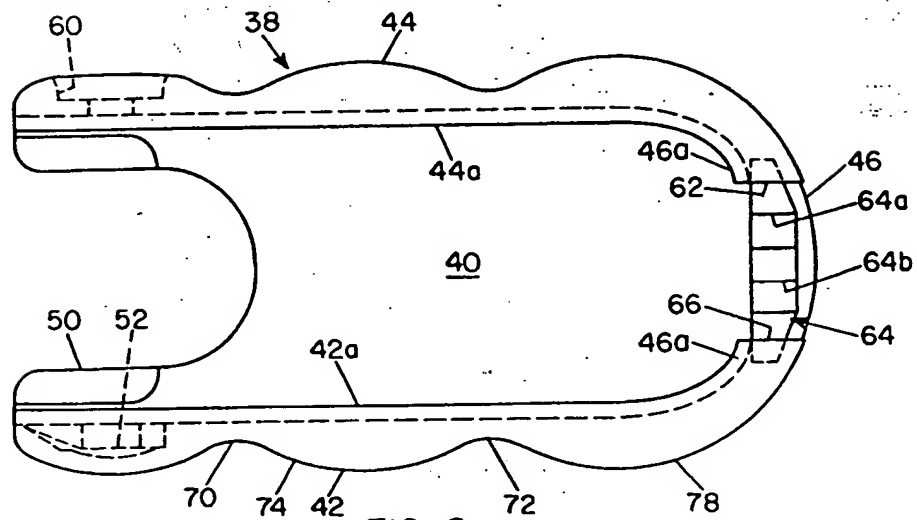


FIG. 9

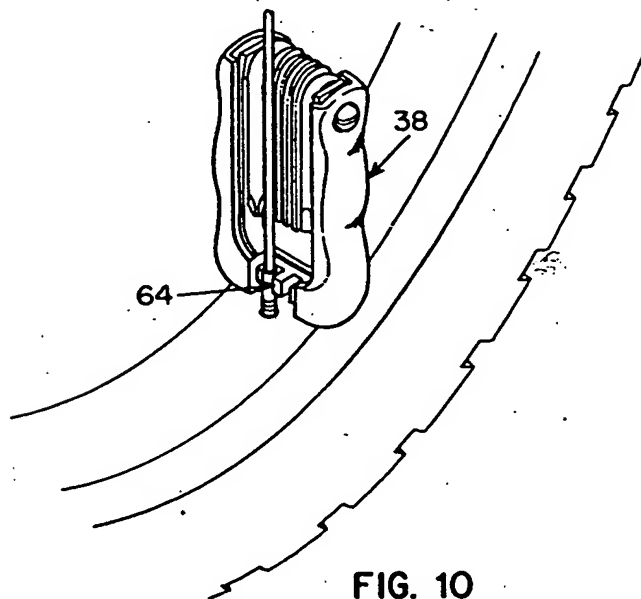


FIG. 10



EP 92 10 4073

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.5)
X	FR-A-1 567 445 (C. ORLANDO)	1,2,7	B25B27/00
Y	* page 2, line 1 - line 19; figures 1-4 *	3,4,8	B25F1/04
Y	US-A-1 656 259 (F. YOUNG)	3,4	
	* page 1, line 60 - line 102; figures 1-3 *		
Y	WO-A-8 804 221 (GLI INDUSTRIES)	8	
	* page 9, line 1 - line 8; figure 4 *		
A	GB-A-148 506 (M. SACHARELO)	5,9	
	* page 1, line 19 - line 25; figures *		
A	DE-A-3 545 978 (E. RIXEN)	5,9	
	* abstract; figures 1,2 *		
			TECHNICAL FIELDS SEARCHED (Int. CL.5)
			B25B B25F B60B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 JUNE 1992	Examiner VIBERG S.O.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : member of the same patent family, corresponding document	

★ CANN- P62 92-309677/38 ★ EP 503559-A1  
 Multi function folding hand tool for use as bicycle kit accessory - has  
 selection of screw drivers and allen wrenches pivoted on axle within  
 handgrip shaped cover and individually withdrawal for use (Eng)

CANNONDALE CORP. 91.03.12 91US-668079

(92.09.16) B25B 27/00, B25F 1/04

92.03.10 92EP-104073 R(AT BE CH DE DK ES FR GB GR IT LI NL  
 PT SE)

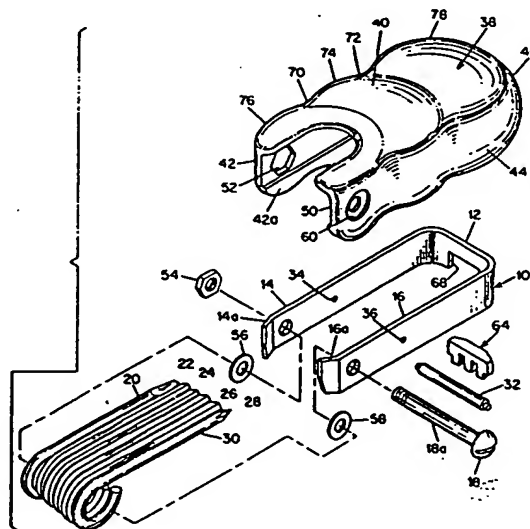
The tool comprises a U-shaped metal carrier (10) with a base (12)  
 and two arms (14, 16) carrying an axle pin (18a) and nut (54), on  
 which are threaded the looped ends of a selection of tools (20, 22, 24,  
 26, 30). The tools include slot and Phillips drivers (20, 30), Allen  
 wrenches (22-28), and two sizes of spoke wrench (64) fitted into a slot  
 (68) in the carrier base (12).

The pivoted tools (20-30) are retained by a press fitted stop pin  
 (32) in a handgrip shaped cover (38) enclosing the whole assembly,  
 and are withdrawn singly for use. The spoke wrench is used with the  
 tool folded.

ADVANTAGE - Has additional spoke wrenches and better  
 handgrip than the existing tool. (8pp Dwg.No.7/10)

CT: DE3545978 FR1567445 GB148506 US1656259 WO8804221

N92-237054



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